

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)	
)	
Commission Seeks Public Comment on)	ET Docket No. 02-135
Spectrum Policy Task Force Report)	

COMMENTS OF NOKIA INC.

Nokia Inc. (“Nokia”) hereby submits its comments in the matter of the Spectrum Policy Task Force Report (“Report”) released in November 2002. Nokia is a global company with 54,000 employees worldwide with key growth areas in wireless and wireline communications. A pioneer in mobile telephony, Nokia is the world’s leading mobile phone supplier and a top supplier of mobile, fixed and IP networks, as well as related services.

Nokia commends the Spectrum Policy Task Force (“Task Force”) for undertaking the considerable job of reviewing spectrum policy and making recommendations that will ensure that U.S. spectrum policy stays current and relevant to the rapidly changing environment it regulates. As the Task Force noted in its Report, spectrum policy is having an increasingly difficult time keeping pace with the ever-growing demands of new and old technologies and services.¹ The Report is an excellent first step towards tackling these challenges.

Nokia welcomes the discussion of the concepts contained in the Report. Many of the ideas discussed in the Report, such as spectrum sharing on a temporal basis, are radical and look far into the future. Early consideration of these promising concepts will allow the Federal Communications Commission (“Commission”) to ready itself for when the new technologies hoped to facilitate these concepts are commercially available on a cost-effective basis.

Exploration of these exciting new concepts must be accompanied by further study of these new concepts and technologies to better understand their potential benefits and costs. Already today there are many international research initiatives underway that are investigating and evaluating forward-looking ideas, such as efficient

frequency sharing methods and flexible spectrum use. The Commission should consider the results of these studies, although many are in their very early stages and consider technologies that are far from being market-ready. The results of these studies should shed light on the feasibility of these concepts for enhancing spectrum utilization and assisting in spectrum management.

However, it should be noted that technology is not a panacea for good spectrum management. The promised benefits of new technologies must be balanced against cost and consumer needs. For example, the benefits of receivers that are more tolerant of interference should be weighed against the impact those developments have on price, size and power to ensure that equipment remains attractive and useful to end-users.

The Report focuses on the Commission, its policies and the spectrum it regulates. This is a good first step towards evolving spectrum policy to meet the challenges of tomorrow's spectrum environment. Understanding that the scope of this Task Force and its Report were limited, Nokia strongly believes that any truly significant spectrum reform must include all spectrum users, not just those subject to the Commission's jurisdiction. As Nokia stated in its previous comments², key elements of good spectrum policy such as long-term planning, global harmonization of spectrum, flexibility and introduction of market-oriented policies should be applied to all users, commercial, government or public service entities. Without applying these policies to all players, including Federal users, it will be difficult to address real and challenging problems such as interference management and access to spectrum successfully. For that reason, Nokia urges a close examination of the current bifurcated spectrum management structure. Including the National Telecommunications and Information Administration (NTIA) and its users in the spectrum policy reform process is critical to achieving real change.

Key Elements of New Spectrum Policy Recommendations

The Task Force recommends that the Commission maximize flexible use of the spectrum within the technical parameters of the allocation.³ Nokia concurs that technological choices and decisions on use of the frequencies are best left to the users in commercial bands, provided there are sufficient technical rules in place to avoid interference

¹ *Spectrum Policy Task Force Report*, U.S. Federal Communications Commission Spectrum Policy Task Force, November 2002, p. 1

² *Nokia Comments in the Matter of the Spectrum Policy Task Force Notice of Inquiry*, ET Docket No. 02-135, July 8, 2002, p.2

and take consumer needs into account. Nokia believes flexibility is best introduced on a going-forward basis by introducing additional flexibility in allocations and service rules to new spectrum first. To avoid creating regulatory uncertainty, caution should be exercised when considering additional flexibility for existing licenses on a retroactive basis.

While it is important to allow market forces to work, there remains a role for the Commission in creating regulatory certainty for spectrum users. Clear technical rules and some general parameters for use are critical to efficient spectrum utilization by avoiding interference.

Nokia supports the Task Force's recommendation that the Commission conduct periodic reviews of spectrum to accommodate new developments in technologies and uses.⁴ Long-term planning should be part of the spectrum management process to ensure that sufficient spectrum is made available in a timely manner for new services or growth in old services and to ensure that spectrum made available is put to its most efficient use. For example, the Task Force's recommendation that future allocations attempt to group like services⁵ is a wise one. Long-term planning creates a useful broad roadmap for spectrum allocations and provides the regulatory certainty necessary for manufacturers and operators to begin developing new products and services for the future.

Nokia agrees with the Commission that it is useful to conduct these reviews every 10 years or so to ensure that users have regulatory certainty to justify investment, particularly for resource-intensive licensed services, and sufficient time for new services to hit market maturity. Likewise, strong license renewal expectancy is important to creating regulatory certainty for users and investors. At the same time, where the Commission finds upon review that spectrum is not being used efficiently or where markets have failed to materialize, the Commission should take a stronger role in reallocating that spectrum to better uses. Caution should be exercised in granting retroactive flexibility to existing licensees when their business plans have failed. The Commission should not get into the business of creating markets for licensees that have failed to succeed in the markets their licenses were originally intended.

³ *Spectrum Policy Task Force Report*, U.S. Federal Communications Commission Spectrum Policy Task Force, November 2002, p.16

⁴ *Ibid*, p. 24

⁵ *Spectrum Policy Task Force Report*, U.S. Federal Communications Commission Spectrum Policy Task Force, November 2002, p. 24

Forward-looking planning should also attempt to harmonize spectrum with international uses to the greatest extent possible so that users, manufacturers and operators can take advantage of the benefits of economies of scale through lower costs for services and equipment, a greater variety of innovative features and quicker time to market for new products, as well as global roaming for some types of services and equipment.

Interference Avoidance

Improving interference management should be a key objective of spectrum policy and Nokia commends the Task Force for grappling with such a critical issue. Attempting to understand the interference environment by gathering better data is a first good step. This information may be useful in helping existing systems in that band to improve their performance and efficient use of the spectrum, provided these improvements are reasonably balanced against the costs. However, gathering and maintaining sufficiently current data for key bands, services and geographic regions may be difficult and costly. The costs, labor and time involved in such a project should be carefully weighed against the potential benefits of such a scheme.

The Task Force recommends migrating to an “interference temperature” whereby “maximum permissible levels of interference [are set], thus establishing the ‘worst case’ environment in which a receiver would be expected to operate.”⁶ This is an interesting concept, but the objectives of this concept need to be clear and there are a number of difficulties in its implementation.

For example, the prime objective of an interference management scheme should be to keep noise to a minimum. According to Shannon’s law⁷, the capacity of spectrum decreases as the noise floor rises. Spectrally efficient systems exploit as much of the capacity as possible. Any increase in the noise floor will reduce the overall capacity of the spectrum, even reducing the capacity of the newly introduced device or system that is causing the rise in noise. It is not clear how the interference temperature metric will accommodate changes in the environment, particularly if new services are permitted into the band, raising the noise level.

⁶ *Ibid*, p.5

⁷ $C = W \log_2(1 + S/N)$, where C is the channel capacity in bits per second, W is the bandwidth in hertz, and S/N is the signal-to-noise ratio.

As noted above, establishing an interference temperature metric for each band, service or geographic region may prove hard to define. The concept of interference temperature monitoring requires that a reasonable protection distance between devices be established (as at a very close proximity, the interference temperature will always exceed the limit). However, for many kinds of devices, the devices may be co-located on the same person or even in the same device, making it impossible to separate interfering devices.

If implemented, interference temperature could encourage existing systems to improve their receiver performance and increase their efficient use of spectrum. However, any benefits of increased capacity should accrue to existing licensees rather than new services, particularly any introduced through an easement on the licensees' rights. To do otherwise, would create a disincentive for existing users to improve their performance if that improvement leads to more underlay users and reduced capacity in a licensee's band.

The Commission should explore alternative models to interference management. For example, interference rights could be approached from a trading angle, in a similar way to pollution rights. Loser spectrum masks may be possible by compensation agreement with the licensee of the adjacent band. However, even this model presents challenges as economies of scale and market dynamics make it unlikely that a wide choice of spectrum masks would be manufactured.

Spectrum Usage Models

Nokia supports the Task Force's conclusion that both exclusive rights and commons models should be expanded in a balanced fashion.⁸ Both models provide unique benefits. Under the exclusive rights model, licensed users operate in a protected environment with regulatory stability and in turn make significant investments to build robust, often nationwide systems with high quality of service. Conversely, under the commons model, free spectrum provides a home for new and innovative technologies, while shared spectrum provides incentives for users to develop more spectrally efficient systems, often more local in nature, that are capable of tolerating greater interference.

⁸ *Spectrum Policy Task Force Report*, U.S. Federal Communications Commission Spectrum Policy Task Force, November 2002, p.37

That is not to say that the ‘commons’ model should always imply deregulation. In fact, free access means there is a greater need for regulation to ensure efficient use of spectrum. To this end, strict power limits and etiquettes such as ‘listen before transmit’ will sometimes be important.

However, Nokia disagrees with the Report’s statement that “the Commission might find it beneficial to incorporate elements from more than one model” and that “spectrum that is licensed under an exclusive approach model could also be subject to an ‘underlay’ easement that is available to low-power unlicensed devices using a commons approach.” Mandatory underlays or easements create a deterrent for operators to invest in improved performance or increased spectrum efficiency by giving the benefits of excess capacity to other users. Conferring underlay rights on new entrants should be voluntary and by agreement with the existing licensees.

Nokia encourages the Task Force to encourage interference avoidance with a more market-oriented approach. Facilitating secondary markets so that existing licensees can lease their excess capacity – on a temporal, frequency or geographic basis --- encourages better use of the spectrum by providing existing operators with a market incentive to improve their spectrum efficiency and tolerance to interference. It should be noted that with secondary markets, as with the original allocated spectrum, the uses should be constrained by the original technical service rules and allocation parameters to assure avoidance of interference. Nokia concurs with the Report that in any case, retroactive easements should be avoided⁹ as these negatively impact existing licensees and are at odds with market-oriented policies.

Promoting Access to Spectrum

Nokia supports the Task Force’s recommendation that secondary market policies be pursued in licensed bands so that licensees can provide access for opportunistic uses where they deem appropriate.¹⁰

Nokia believes the Task Force is correct to seek additional information on the implications of and mechanisms for using “white spaces” as new technologies may become commercial available in the future that could facilitate this use. Although many of these technologies, such as truly frequency agile Software Defined Radios (“SDRs”), are not yet ready for widespread commercial use, in some years they may help to better exploit existing “white spaces” on a temporal or geographic basis. It is important that the Commission begin to work with industry to develop appropriate etiquettes and sharing mechanisms that will be needed for these technological advances. Experience in

⁹ *Ibid*, p.53

the past has shown that this process can be difficult and long. For example, in the case of dynamic frequency selection (“DFS”) in Wireless Local Area Networks (“WLANs”) in the 5GHz frequency range, it has taken significant time and cooperation by the multiple players involved to define how this mechanism should operate. However, the results can be quite beneficial to all parties when consensus is reached.

Nokia is pleased to see that the Task Force is taking a careful and thoughtful approach to opportunistic access through government-granted easements. As noted above, exploitation of white spaces in licensed bands should be done on a voluntary and market-oriented basis rather than through easements. Mandatory underlays could disadvantage licensees and discourage them from exploring more efficient use of their spectrum. Moreover, as noted by the Task Force, the transition issues associated with government-granted easements would be very difficult.¹¹

It should be cautioned that while use of white spaces will certainly help ensure that more of the spectrum is used most of the time that this may not help alleviate spectrum scarcity at the busiest times or in the most congested places. Many white spaces are not being used because that time (for example, nights and weekends) or location (for example, less populated rural areas) is less attractive to users and experiences less demand. However, it is positive that the Commission is exploring greater exploitation of these holes.

Summary

In summary, Nokia applauds the Task Force for its work that represents an exciting first step towards the spectrum management reform needed to deal with the challenges of spectrum policy in the 21st century. The ideas contained in the Task Force’s November 2002 Report are exciting and warrant further research, study and development. Nokia encourages the Task Force to investigate these concepts and technologies to determine the extent to which they can enhance spectrum management.

At the same time, technology cannot be a substitute for good spectrum management. Consumer needs, such as the cost and usefulness of new technology, should not be forgotten in the search to implement new technologies that may be able to enhance important spectrum management goals such as efficient spectrum use. Nokia encourages

¹⁰ *Ibid*, p 63

the Task Force to consider this and other key spectrum policy elements, like global harmonization of spectrum, long-term planning, flexibility and the application of market-oriented policies to all users, commercial, government or public service entities. Nokia looks forward to working with the Task Force as it moves forward with the process of spectrum management reform.

¹¹ *Ibid*, pp. 61-62